FOREST TENT CATERPILLAR

in the prairie provinces

89-00178/

Although this brochure contains the latest technical information available, application of the chemical recommendations is at the user's risk and subject to any law that may apply.

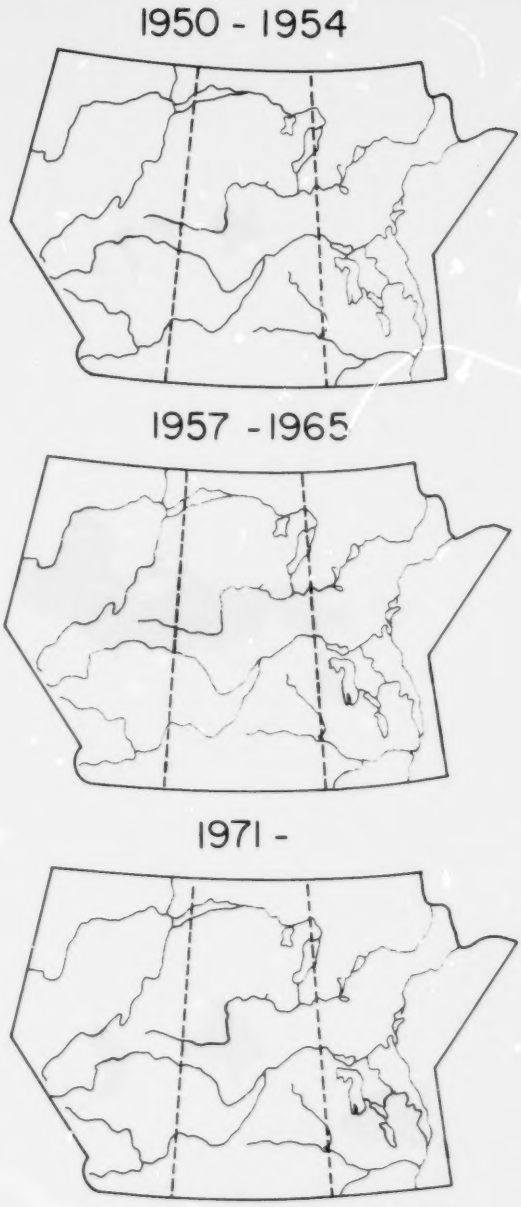
May, 1975

INTRODUCTION

The forest tent caterpillar, **Malacosoma disstria** Hbn., is an important pest throughout Manitoba, Saskatchewan, and Alberta. When populations are high the insect attracts public attention because deciduous trees, shrubs, and forest undergrowth are often completely stripped of foliage, and hundreds of square miles of countryside left as bleak as during mid-winter. Outbreaks of 3-6 years' duration—occasionally persisting for 10 or more years—occur at irregular intervals ranging from 6 to 16 years. These outbreaks originate following a single year with a relatively cool winter and an unusually warm spring.

The first indication of an outbreak is a general increase in larval abundance followed 2-4 years later by widely scattered patches of defoliation. As these infestations continue to develop they tend to coalesce, resulting in areas of continuous severe defoliation some 4-6 years after the initial population increases were noted.

Because the full-grown caterpillars have the habit of migrating or wandering about in great numbers in search of new food supplies or suitable cocooning sites, the insect often becomes highly annoying to residents, tourists, and vacationers. The wandering caterpillars may invade houses, cottages, trailer homes, and other buildings, and frequently swarm over roads in such large numbers as to interfere with the movement of traffic.



Distribution of the forest tent caterpillar 1950-1975.

OUTBREAK HISTORY

Infestations of the forest tent caterpillar in North America date back at least 200 years. During the past 25 years three major outbreaks of the pest have been recorded in the Prairie Provinces by the Forest Insect and Disease Survey unit of the Canadian Forestry Service. The first occurred during the period 1950 to 1954, the second during 1957 to 1965, and the third began in 1971 and is still in progress.

The 1957-1965 outbreak was by far the most widespread, and at its peak extended over some 350,000 km^2 (135,000 sq miles) of trembling aspen in the parkland, mixedwood, and northern coniferous forest regions of the provinces.

Recently emerged larvae feeding on an aspen bud.

HOST TREES AND SHRUBS

Trembling aspen is the principal host of the forest tent caterpillar. Because aspen is widely distributed and occurs in nearly pure stands, a natural situation is created for the development of widespread severe outbreaks. Other tree species such as cottonwood, Manitoba maple, birch, ash, oak, elm, basswood, and balsam poplar are also readily attacked in natural stands, in parks, and in urban centers, especially where they are found in association with trembling aspen. When caterpillars are extremely numerous and food supplies scarce, the insects feed upon nearly all green foliage, including forest undergrowth, garden crops, ornamental shrubs, fruit trees, and even tamarack and spruce in wooded areas.

LIFE STAGES

Egg—Laid in bands 5-15 mm long completely encircling the smaller twigs of host trees and shrubs; usually 150-200 (but occasionally as few as 100 and as many as 300) eggs per band. The eggs are gray in color and are covered with a protective substance called spumaline. When freshly laid the bands appear silvery, but later they darken in color and look more like the bark to which they are attached.

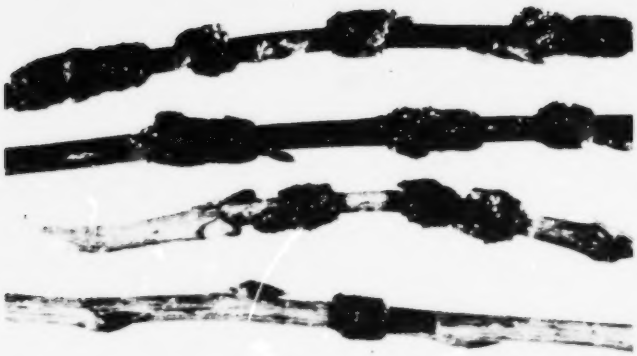
Larva—Black with conspicuous dark hairs during the early feeding stage but they change color as they develop. Fully grown caterpillars are dark brown with a broad band of blue along each side, and have a prominent row of white-to cream-colored keyhole-shaped spots down the center of the back. They range from 45 to 55 mm in length.

Pupa—Brownish to black and enclosed in light-yellowish silk cocoons that are spun between the leaves of host trees and other vegetation, in bark crevices, or occasionally on buildings, fence posts and rails, etc. Fully developed pupae are about 20 mm long.

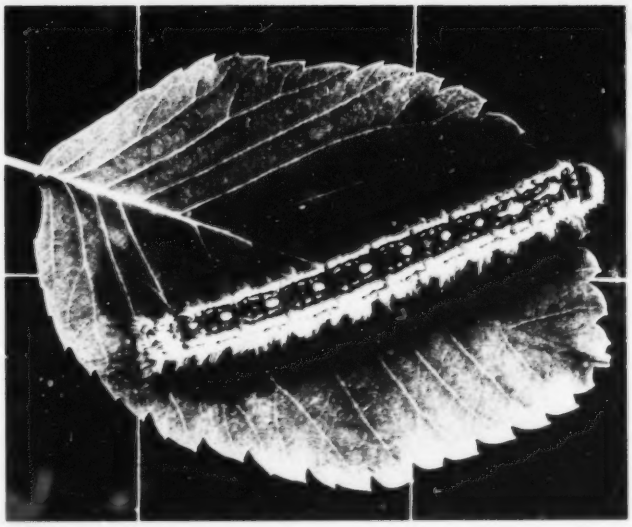
Adult—Light yellow to buff-brown in color with two dark oblique bands running across the forewings; wingspread from about 30 to 45 mm. Females are stout-bodied while males are more slender.

Cocoons spun between aspen leaves.

Pupa in cocoon.

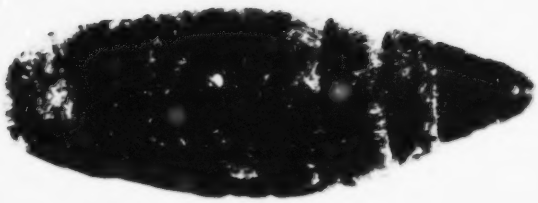


Egg bands.



Fully-grown larva.

Cocoon.



Pupa.

Adult - male.

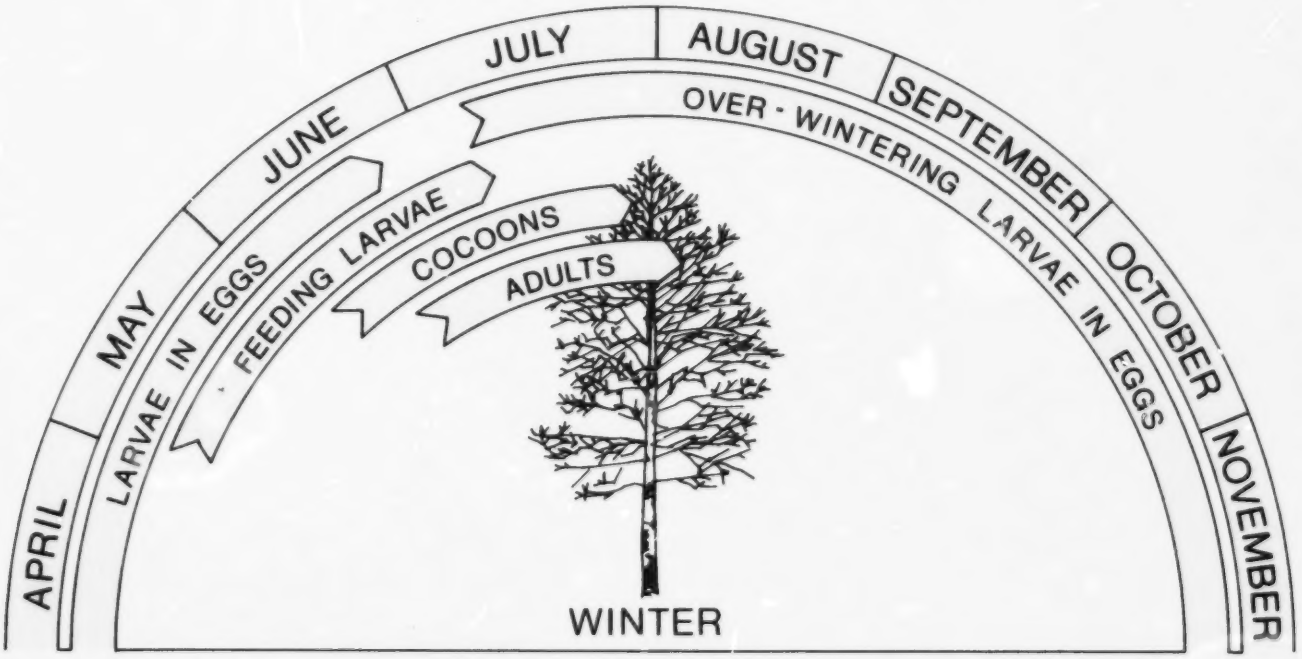
Adult - female.

LIFE HISTORY AND HABITS

There is one generation of the forest tent caterpillar per year. The eggs are laid in July and early August. The embryos develop into first-instar larvae within 3 weeks. These larvae overwinter in the eggs and hatch the following spring about the time that trembling aspen leaves begin to unfold. The hatching time may vary depending upon prevailing weather conditions and locality. Warm, dry weather in late April and early May usually stimulates early and rapid hatching, whereas cool, wet weather delays incubation and prolongs the hatching period. Survey records in Manitoba, Saskatchewan, and Alberta over the past 40 years show that hatching may occur as early as May 1 and as late as July 10, but the long-term average is mid-May.

When first hatched, the tiny black caterpillars cluster together while feeding on the opening buds and developing foliage. Contrary to its name, the forest tent caterpillar does not construct a tent. Instead, the young caterpillars spin silken threads along which they travel. They often cluster on the sunny side of the trunk and main branches of a tree or shrub when resting or moulting (shedding their skin), or on the sheltered side when not feeding because of adverse weather conditions. The caterpillars moult four times during the season. Evidence shows that most of the feeding takes place during the last larval stage. At the time of the fourth moult a caterpillar may have eaten the equivalent of 1½ leaves, but between the fourth moult and the cocoon stage it will consume up to 7 leaves.

Five to eight weeks (depending on local weather temperatures) after hatching, the caterpillars spin silken cocoons within which they remain for about 10 days in the pupal stage before emerging as adults. Pupae may be found as early as June 4 and in extreme exceptions as late as August 30, but generally pupation occurs during the first and second weeks of July. The moths live 5-10 days and are active in late afternoon and evening. Great numbers are attracted to lights, especially in towns and larger urban centers. Infestations are spread primarily by adult flight. The turbulent air associated with cold weather fronts is often responsible for transporting the moths over several hundred miles.



Life history of the forest tent caterpillar.

INJURY

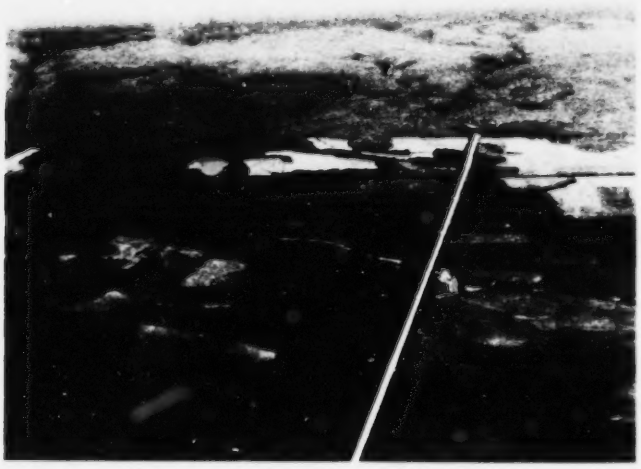
The forest tent caterpillar causes injury by defoliation, but the severity is determined by the number of larvae present. Low populations cause a noticeable thinning of the foliage in the upper crown. High populations strip the tree completely of foliage. Depending on the size of the tree crown, 10-20 egg bands on trembling aspen trees 12.5 cm (5 in.) in diameter at breast height usually produce enough caterpillars to cause complete defoliation.

Heavy loss of leaves for 2 or more years results in a general decline in the vigor of host trees. This is accompanied by dieback of twigs and branches and a significant reduction in radial growth. Studies carried out in Manitoba and Saskatchewan between 1951 and 1954 showed that the increment losses due to severe defoliation in average-stocked trembling aspen stands amounted to almost 4.5 m^3 (stacked) per ha (½ cord per acre) annually over the 4-year period. A corresponding study in Alberta carried out between 1957 and 1970 indicated an 80-90% loss in radial increment after 3 years of severe defoliation.

Serious tree mortality does not normally occur because most outbreaks are short lived—less than 4 years—and severely defoliated trees refoliate later in the season. However, there is evidence that if complete loss of leaves occurs for more than four consecutive seasons as many as 80% of the trembling aspen can be killed. Investigations have also shown that prolonged periods of severe defoliation increase the susceptibility of the trees to disease infection, especially Hypoxylon canker, **Hypoxylon mammatum**, which can become an important contributing factor to mortality.

Supressed [a] and normal [b] radial growth of aspen.

Severe defoliation of aspen.



Aerial view of severe defoliation [background]—Riding Mountain National Park 1974.

CONTROL

Natural

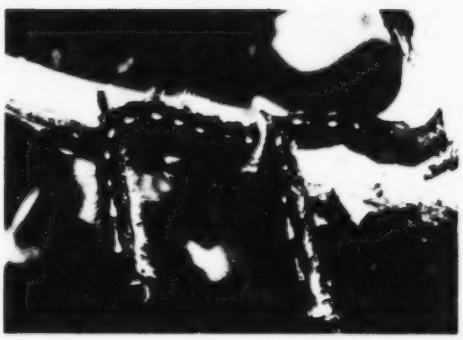
Several adverse environmental factors contribute to the natural control of the forest tent caterpillar. Mass starvation due to exhausted food supplies before the caterpillars are fully grown is an important factor in initiating population decline. Birds feed to some extent on young caterpillars, and diseases (virus and fungus) often kill an enormous number of larvae in older infestations.

There are over 40 known species of insect parasites that attack the forest tent caterpillar during its various stages of development. The flesh fly, **Sarcophaga aldrichi** Park., is one of the most important of these, sometimes reducing the host population by 80% or more during the late stages of the outbreak. This fly deposits living maggots on the cocoons which burrow through the silken cases to feed on the pupae within. Unfortunately the flesh fly occasionally becomes so numerous that it is as much of a nuisance as the host insect.

An ichneumonid wasp, **Itoplectis conquisitor** (Say), is also an important parasite and substantially reduces larval populations.

There is also evidence that qualitative or genetic differences within populations of the forest tent caterpillar are associated with marked fluctuations in their numbers.

Unfavorable weather conditions, however, appear to be the most important natural control factor. Outbreaks can be terminated abruptly by cold weather shortly after the eggs hatch in the spring. Freezing temperatures destroy the foliage and decrease the mobility of the larvae, thus reducing the numbers by starvation. In Ontario and eastern Manitoba an outbreak in 1953 was reduced by 95% over a period of three days due to wet freezing weather shortly after larval hatch. Above-average fall temperatures can also cause a rapid decline in an outbreak by killing many of the larvae within the eggs.



Larvae killed by a virus.

Ichneumonid wasp.

Flesh fly.

Applied—Ground

During periods of extremely high larval abundance, the timely application of a suitable insecticide will prevent heavy loss of foliage and subsequent injury to ornamental trees and shrubs or high-value park and forest stands. Chemical sprays will also reduce the nuisance of wandering caterpillars in resort areas, towns, and villages and around farmsteads.

In order to decide if spraying is required it is necessary to know whether caterpillar populations are going to remain high. This information can be obtained for specific locations or areas by determining the abundance of newly-laid egg bands on the trees. A commonly used procedure is to fell three representative trembling aspen trees at each sample location, examine the branches to ascertain the average number of egg bands per tree, and relate the number found to the diameter of the tree at breast height as indicated in the table. If felling the trees is not feasible they may be searched for egg bands using binoculars. Sampling can be conducted at any time during the fall and winter months, and provides a reasonably accurate prediction of expected populations. However, care should be taken

Diameter breast height		No. of egg bands
cm	in.	
2.5	1	2
5.0	2	5
7.5	3	9
10.0	4	11
12.5	5	14
15.0	6	19
etc.		

Number of egg bands by tree diameter that will cause complete defoliation.

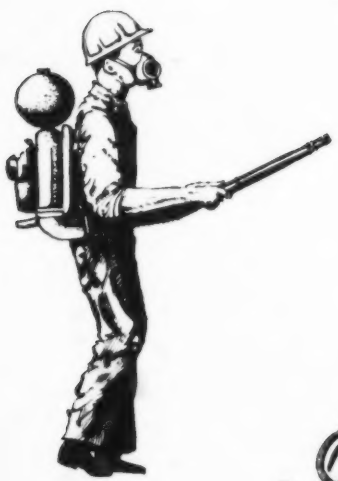
not to count old, and obviously empty, egg bands which tend to persist on twigs for a year or more. Since outbreaks can be terminated abruptly by natural factors, it is essential that these surveys be complemented in the spring by field assessments of percentage larval hatch.

A sequential system is also available for sampling forest tent caterpillar egg populations, but problems have been encountered with practical application in the field. Further information concerning the use of this system may be obtained from the Canadian Forestry Service.

If control measures are undertaken they should be carried out in late May or early June while the larvae are still small, preferably before they reach the fourth instar, and before defoliation becomes advanced. Carbaryl, malathion, and methoxychlor are registered chemical insecticides for forest tent caterpillar control, and may be applied with high-pressure sprayers equipped with hose and gun, mist blowers, or pressure hand sprayers. The microbial insecticide, **Bacillus thuringiensis**, is also effective and can be applied with the various types of hydraulic sprayers.

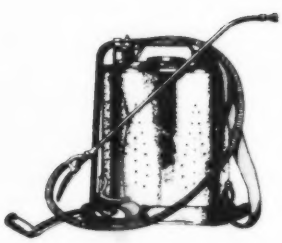
The control achieved in any spray operation depends on the care taken during application. The correct type of equipment for the job should be selected. Powered high-pressure sprayers and mist blowers are most suitable for treating large trees (or stands of trees) that are readily accessible from the ground. High-pressure sprayers deliver a large volume of dilute spray mixture, and a sufficient quantity should be used to wet all of the foliage to the drip point. Mist blowers are designed to apply a low volume of highly concentrated insecticide mixture, and only enough should be used to moisten the foliage.

Hand-pumped sprayers are usually adequate for treating medium-sized ornamentals up to 4.5 m (15 ft) in height. Where only a few small trees are involved, the insect can be controlled effectively either by removing the egg bands or by using pressurized aerosol sprays and dusts when the caterpillars are present. Garden-hose sprayers are also practical for spraying shrubs and medium-sized trees, but should be used only as directed by the manufacturer.

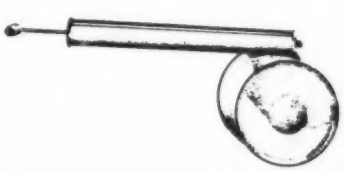


Portable mist blower.

Garden-hose sprayer.



Aerosol sprayer.



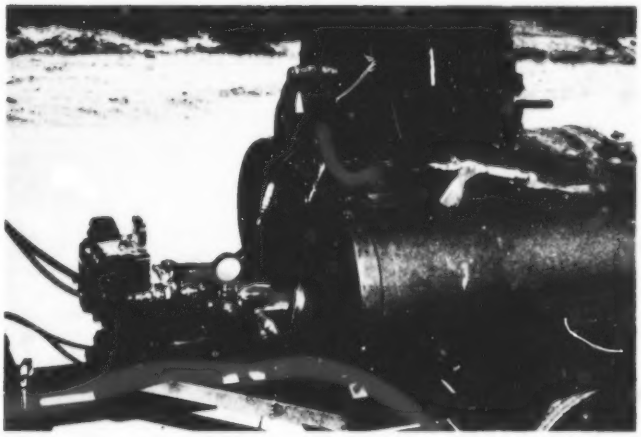
Small hydraulic sprayers.

RECOMMENDED SPRAY RATES FOR INSECTICIDES

Insecticide	Type of Sprayer: Truck and Trailer Mounted[1] Pressure Sprayers — 500 litres water	100 gallons[5] water	Knapsack and Hand Pumped[2] Pressure Sprayers — 5 litres water	1 gallon[5] water
Chemical[3]				
Malathion EC	250 ml	8 oz.	4 ml	1 tsp.
Methoxychlor EC	250 ml	8 oz	4 ml	1 tsp
Carbaryl WP	500 g	16 oz	8 g	2 tsp
Microbial[4]				
Dipel WP	625 g	20 oz	—	—
Thuricide FLO.	625-950 ml	20-30 oz	—	—
Organic Garden Spray	—	—	4-8 ml	1-2 tsp

1. Commercial and farm shelterbelt use.
2. Urban homeowner use.
3. Rates shown in active ingredient.
4. Contain **Bacillus thuringiensis**; shown in label rates.
5. Imperial measure.

Note: For mist blower applications increase amounts of chemical insecticides 4 times and microbial insecticides 10 times for the same amount of water.



High volume hydraulic sprayer.

Low volume mist blower.

Applied—Aerial

Aerial spraying is the most practical method of applying insecticides when large acreages require treatment. Malathion at the rate of 370 ml active ingredient in 9.4 litres of water per ha (5 oz. in 1 U.S. gal water per acre) applied by aircraft will provide good control around farmsteads, in park and resort areas, or in high-value forest stands. The microbial insecticide Thuracide 16B, containing **Bacillus thuringiensis**, is also recommended for aerial application at the rate of 1.5-2.2 litres in an equal amount of water per ha (20-30 oz per acre).

In addition to the area to be protected with the insecticide, it is necessary to spray a buffer strip 60-90 m (200-300 ft) wide as protection against migrating caterpillars.

Approval must be obtained from provincial government authorities for large scale aerial applications of insecticides. If malathion is being used, care must also be taken to prevent spray drift from contaminating adjacent garden and field crops, hay lands, lakes, rivers, and streams.

Insecticides are toxic to humans, animals, birds and fish. Follow all instructions and precautions listed by the manufacturer.

SELECTED READING

Baker, W. L. 1972. Eastern forest insects. U.S. Dep. Agric., Misc. Publ. No. 1175, pp. 330-333.

Batzer, H. O. and W. E. Waters. 1956. Forest tent caterpillar. U.S. Dep. Agric., For. Serv. Pest Leafl. No. 9. 4 pp.

Bird, F. T. 1971. **Malacosoma disstria** Hubner, Forest tent caterpillar. **In:** Biological control programmes against insects and weeds in Canada 1959-1968. Commonw. Agric. Bur. Farnham Royal, Slough, England. pp. 144-148.

Blais, R. J., R. M. Prentice, W. L. Sippell, and D. R. Wallace. 1955. Effects of weather on the forest tent caterpillar, **Malacosoma disstria** Hbn., in central Canada in the spring of 1963. Can. Entomol. 87:1-8.

Brown, C. E. 1965. Mass transport of forest tent caterpillar moths, **Malacosoma disstria** Hbn., by a cold front. Can. Entomol. 97:1073-1075.

Brown, C. E. 1966. Habits and control of the forest tent caterpillar, **Malacosoma disstria** Hbn. Can. Dep. For. Misc. Publ. No. Fo 23-966. 6 pp.

Campbell, I. M. 1966. Genetic variation related to survival in Lepidopteran species. **In:** Gerhold, H. D., Schreiner, E. J., McDermott, R. E., and W. E. Winieski, eds. Breeding pest-resistant trees. Oxford, England, Pergamon Press. pp. 129-135.

Fashingbauer, B. A., A. C. Hodson and W. H. Marshall. 1952. The interrelations of a forest tent caterpillar outbreak, songbirds and DDT application. Flicker, 29:132-147.

Hildahl, V. and W. A. Reeks. 1960. Outbreaks of the forest tent caterpillar, **Malacosoma disstria** Hbn., and their effects on stands of trembling aspen in Manitoba and Saskatchewan. Can. Entomol. 92:199-209.

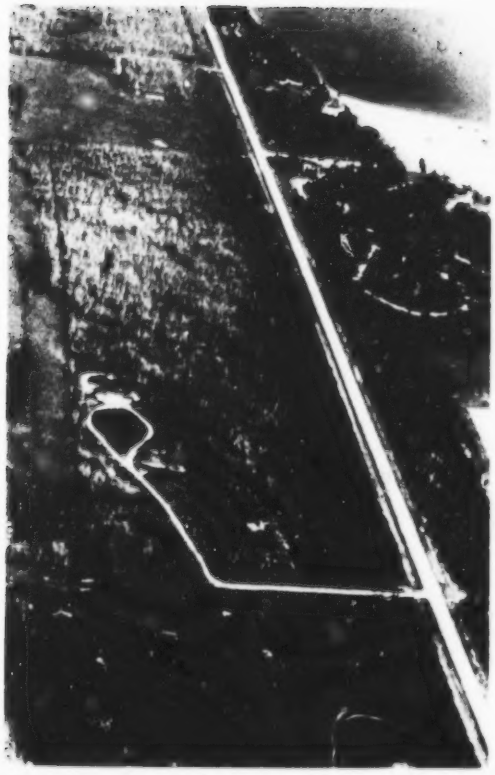
Hodson, A. C. 1941. An ecological study of the forest tent caterpillar, **Malacosoma disstria** Hbn., in northern Minnesota. Univ. Minn. Agric. Exp. Stn. Tech. Bull. 148. 55 pp.

Ives, W. G. H. 1971. The forest tent caterpillar in Alberta. Environ. Can., For. Serv., North. For. Res. Cent. Edmonton, Alta. Intern. Rep. NOR-4. 28 pp.

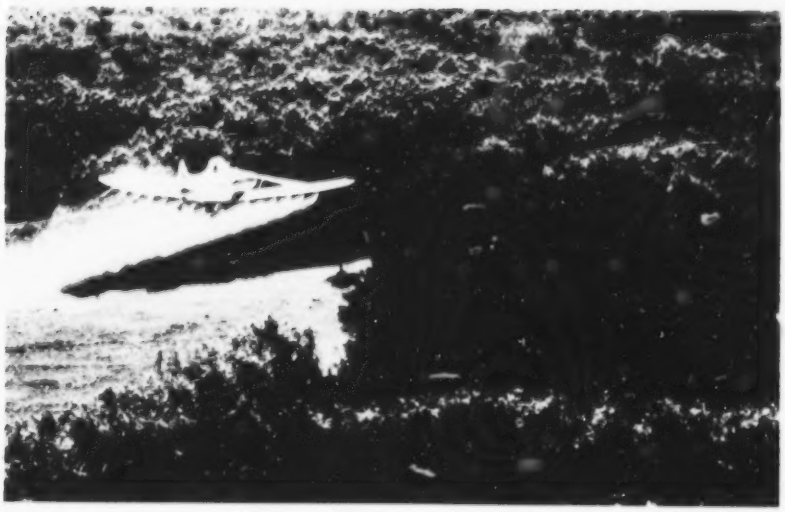
Ives, W. G. H. 1973. Heat units and outbreaks of the forest tent caterpillar, **Malacosoma disstria** (Lepidoptera: Lasiocampidae). Can. Entomol. 105:529-543.

Kulman, H. M. 1971. Effects of insect defoliation on growth and mortality of trees. Ann. Rev. Entomol. 16:289-324.

Sippell, W. L. 1961. Key to the puparia of common dipterous parasites of the forest tent caterpillar, **Malacosoma disstria** Hbn., in Ontario. Can. Entomol. 93:433-436.



Applying insecticides by air.



Foliage protection provided by aerial application of malathion, Manipogo Park, Manitoba, 1974. Treated stands on right, untreated to left of highway.

Additional information and copies of this report may be obtained from:

Northern Forest Research Centre
Canadian Forestry Service
Environment Canada
5320 - 122 Street
EDMONTON, Alberta
T6H 3S5

Environ
Canada